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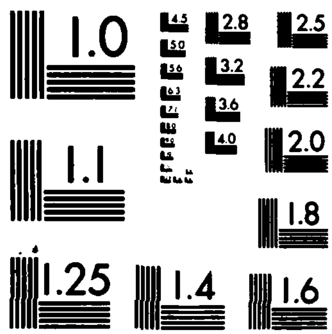

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SUMMARY

Treatment of combat casualties is a more difficult task than treatment of illnesses and injuries in a civilian setting because treatment under combat conditions must be carried out while the patient is moved through the evacuation chain. To insure the continuity of care during this process, the systematic communication of information critical. Vital information needs to be documented at each step of treatment, passed through the evacuation chain with the casualty and entered into the permanent patient records for long-term retention.

New weapons systems are expected to make future battles more intense and mobile than past conflicts; therefore, the armed services must be prepared to evacuate casualties more rapidly than in the past. In order to provide integrated patient care under such frenetic conditions, attention is being focused on automated systems for medical recordkeeping and communications functions. Before an automated system can be designed or developed, however, it is necessary to review the existing system of casualty care with an eye toward functions that can be automated, consider specific types of data and records that are required, evaluate the available hardware technology, and examine the potential uses that the database may have beyond the provision of medical history information required for immediate patient care.

In the Marine Corps an echeloned system of care is used to provide medical treatment as soon as possible and to avoid moving the casualty any further along the evacuation chain than necessary. At the first treatment echelon is the company corpsman who provides first aid. Echelon II consists of the Battalion Aid Station which is equipped for resuscitation and minor surgery. At echelon III facilities hospital companies and medical battalions staffed by medical support specialists provide some definitive care. A broader spectrum of definitive care is provided by echelons IV and V fleet hospitals.

Certain medical information is required for adequate combat casualty care. Such data were identified and documented for the first three echelons of medical care.

The technology available for automating the combat medical record includes microcomputers and a variety of peripheral devices that will interface with a microcomputer through an RS 232 connector. The primary microprocessor considered for combat casualty care is the field hardened IBM Series I computer. Currently, this machine operates with 64KB of RAM, has a 9-inch video display, two 8-inch floppy disk drives, and a detachable keyboard. Data capture media identified for this machine include a card with a magnetic stripe, a card with an alterable semi-conductor encapsulated within it, a card surfaced with optical recording material, forms containing bar coded information, forms imprinted with material that can be read by optical character recognition devices, and speech.

A system design suggested for automating casualty care would use a microprocessor at echelon III. Data would be supplied to the microprocessor via a revised medical card, electronic storage media, and possibly portable terminals. The revised medical card would be designed to take advantage of bar coded information, or optical character recognition, or other applicable devices to facilitate data input. Electronic storage media could provide medical history data on combat casualties. For example, an electronically encoded tag worn by the individual could supply basic

demographic data as well as blood type and allergy information. Portable terminals could be used to input information as it is obtained at bedside and would obviate having to remove a casualty's tag in order to decode it. Once casualty data is in the microprocessor it can be used in a variety of ways, such as printing a patient data sheet that can be incorporated into the permanent patient record. Reports can also be sent to the medical regulating agency where an evacuation policy is devised, or sent to commands responsible for estimating supply or resupply needs. Additional reports can be generated for personnel accounting, epidemiology, and medical intelligence.

Treatment of Marine Corps combat casualties is a more difficult task than the treatment of illnesses or injuries in a civilian setting because treatment under combat conditions must be carried out while the patient is moved through the evacuation chain. Under battlefield conditions, the systematic communication of medical information is a critical factor necessary to insure the continuity of care. Vital information needs to be documented at each step of treatment, passed through the evacuation chain with the casualty, and entered into permanent patient records for long-term retention. Therefore, the Fleet Marine Force and supporting Naval Amphibious Force require recordkeeping capabilities and analysis tools that can track ill or wounded personnel from initial medical contact in the field to definitive and specialized care facilities, leaving an audit trail of care provided.

The basic doctrine of Marine Corps casualty care is that no casualty is to be evacuated further to the rear than his physical condition or the military situation demands. Therefore, an echeloned system of care is used to position health care providers as close as possible to the source of potential injury and to deliver the maximum amount of care practicable as early as possible. Each successive echelon, then, represents a higher health care delivery capacity and casualties are evacuated to a higher echelon only if their injuries are beyond the capacity of a given echelon. These echelons are as follows:

Echelon I	Field Corpsman at the site of injury
Echelon II	Battalion Aid Station (BAS)
Echelon III	Medical Company (60 beds)/Hospital Company (200 beds)
Echelon IV - V	Fleet Hospital

The first echelon of care is provided by the company corpsman. During engagement of the enemy, the corpsman is in the field with his unit. His equipment consists of a "Unit 1", which provides him with sufficient surgical equipment to perform first-aid and relieve pain. The medical history available at the time of treatment depends upon the corpsman's tenure with the company. A new corpsman may have little or no time to review medical records before combat. A medical warning tag system (BUMED INSTRUCTION 6150.29) exists to alleviate this problem, but these red colored "dogtags" identify only minimal medical data and allergies to medications. The company corpsman generates a casualty's first medical record in the form of the U.S. Field Medical Card (see Figure 1). This card documents sparse information regarding the nature of the medical problem and treatment rendered.

Casualties requiring more care than the company corpsman can provide are moved to the Battalion Aid Station (BAS) or echelon II. The BAS is manned by hospitalmen and medical officers who are equipped for some resuscitation and minor surgery. These personnel will perform those complete treatments which allow the Marine to return to his unit, but there is usually no attempt at debridement and repair of significant wounds in a casualty handling setting. Bleeding from major vessels may be tied off, tracheostomy performed, and fractures stabilized in preparation for evacuation. The first sorting of caualties is done here. The priority of each arriving casualty's care is assessed relative to the casualties already received and being attended. Some

casualties will be treated and returned to the field. Others may be retained briefly but must be evacuated if they cannot return to the field.

The U.S. Field Medical Card, Form DD 1380, 1 June 62 (see Figure 1) is used to record treatments and disposition of evacuees, and if the BAS has the Marine's medical jacket, it is often sent with the casualty. Evacuation to the Medical Battalion, Hospital Company, or to Casualty Receiving and Treatment Ships is by ground or helicopter transport. Evacuation policy is established by area and subordinate commanders and coordinated by the Medical Regulating Agency.

During the first 60-100 hours of a classic amphibious assault situation, facilities to the rear of the BAS are casualty receiving and treatment ships. As action proceeds inland, hospital companies and medical battalions are landed to replace the ships in the chain of evacuation and treatment.

The staffs of these echelon III hospital companies and medical battalions are augmented by medical and support specialists capable of definitive surgical and medical care. Patients may be retained for significant lengths of time because mobility is not an overriding concern. This is the first level from which evacuation can be planned and scheduled, and it may involve other services such as the Air Force Military Airlift Command.

The U.S. Field Medical Card is the only record used to document injury and treatment data until the casualty has reached a hospital setting. This card consists of a cardboard-like original which is wired to the casualty's clothing and a duplicate which is retained by the provider. If one card is filled with information, more cards may be used. It is also possible that a card generated at a lower echelon may be removed and replaced with another if the first card was considered to be inaccurate or redundant even though it is against Marine doctrine. The instructions pertaining to the use of this card (Fleet Marine Force Manual 4-5) state that the card should remain attached to the casualty until he reaches his ultimate destination in the chain of evacuation. However, it was the practice in Vietnam to leave the card attached to the patient until he received his first surgery whereupon a formal inpatient record was generated. Then information from the U.S. Field Medical Card(s) was incorporated into the permanent record, but no standard procedures existed for data transfer. Information thought to be important would be extracted from the Medical Card and then the card might be attached to another page or wedged in the chart holder. The problem resulting from such practices has been the loss of important patient information because certain data may not get extracted from the card, the card might be overlooked, or the card may get misplaced.

Although the U.S. Field Medical Card has been adequate in the past, it may not be adequate in future combat situations where modern weapons are expected to create a highly intense and mobile battlefield (cf. Occhialini, 1982). To provide continuous care to the casualties under those conditions, it will be critical for corpsmen to have ready access to the casualty's medical history, to be able to rapidly record new medical data, to transfer information from one echelon to another accurately and with a minimum of delay or effort, and to quickly integrate data so it can be used for triage and evacuation decisions. In order to meet these recordkeeping and communications demands, health care managers should consider employing the same methods that have

allowed tactical systems to become so responsive in recent combat situations--computerized data processing. Clearly, the value of computers lies in their capacity to store, retrieve, and communicate information quickly and accurately. If automatic data processing technology is to be used for casualty care, questions need to be explored regarding the precise information needed at each echelon of care. It needs to be determined what information should be recorded, the best means to capture and store the data, and the most efficient method for transferring information to various treatment facilities.

DATA REQUIREMENTS

The information required at each echelon of care was a problem given primary consideration at a workshop held to define the Fleet Marine Force (FMF) medical information requirements (Proceedings, 1982). The workshop participants felt that the information required at Echelon I would be that data needed to identify the casualty and establish a casualty care record. This included the Marine's name, social security number, unit, allergies, blood type, and religion. Additional information needed by the corpsman would be the site and type of wound, time of injury, type of narcotics used, time they were administered, whether or not a tourniquet was applied, and the time it was applied.

At the second echelon it was felt by those at the workshop that provisions should be made for more detailed descriptions of the injury and documentation of medications administered. Because of the more extensive medical capabilities of the BAS, information regarding treatments provided, anesthetics used, operative procedures performed,and tubes administered should be recorded. The time and amount of any antibiotics or intravenous fluids administered (e.g., ringers lactate) needs to be recorded. While at the BAS, the casualty's vital signs should be monitored and recorded. These include measurements of temperature, pulse, respiratory rate and respiratory expansion, systolic and diastolic blood pressure, capillary refill, eye opening response, verbal response, and motor response. In addition to the information conveyed by these scores individually, collectively they provide basic data needed to compute the Trauma Score developed by Champion, Sacco, Carnazzo, Copes, and Fouty (1981). The Trauma Score has been adapted and tested for combat situations. It yields a value that can be converted directly to a probability of survival. Thus, the Trauma Score is valuable for rapidly communicating the casualty's status to the next echelon of treatment or to the Medical Regulating Agency.

When the casualty reaches the Medical Battalion or Hospital Company at the third echelon, it is necessary to continue documentation of narcotics, treatments, operative procedures, medications, anesthetics, intravenous fluids, tubes, and vital signs. At this level the casualty is in a stable setting where more extensive treatments can be provided and information regarding blood transfusions, surgery, casting and immobilization are relevant. More extensive diagnostic prodedures such as complete blood counts, urinalyses, blood type and crossmatch, electrolytes, blood gases, and X-rays can be performed and documented. Finally the patient's diagnoses and disposition should be made at this point.

The results of the FMF workshop (Proceedings, 1982) were reviewed by a working group of medical professionals and medical systems developers at the Naval Health Research Center (NHRC). The object of the review was to apply the workshop results to the formulation of a prototype combat medical record. The NHRC working group primarily functioned to identify additional data elements needed in a combat casualty record. For example, based upon experience in civilian trauma care, information about cardiac irregularities, pupil size discrepancies, etc. that represent normal states for the individual might be included. Such information would expedite field diagnosis and treatment of wounded personnel. Disposition also was added at echelon II to provide information on casualties treated and sent back to duty. Finally, an attempt was made to be more specific regarding the basic medical information to be obtained. A table showing the various sections of the combat record, data elements within each section, and the echelon where each data element is needed is shown in Appendix I.

DATA CAPTURE

In addition to considering the specific data required, the attendees of the FMF workshop (Proceedings, 1982) addressed the appropriate level of automation at the various echelons of casualty care. It was generally agreed that at Echelon I the information accompanying the casualty should be both visually and machine readable. It was felt that hand-held computers may not be suitable to use in the combat situations experienced at Echelon I but could be effective at Echelon II. Further, it was generally agreed that a portable computer with a full size CRT screen, disk storage, and printer could not be used until the third echelon was reached.

If one focuses on the Medical Battalions and Hospital Companies as the place to introduce a minicomputer, then a logical candidate for the device to use already exists. In 1981 the Marine Corps took delivery of more than 500 field hardened transportable minicomputers for use at the battalion level of the FMF. Although each Medical Battalion received only one of these computers, they were used to keep records for activities common to all units--personnel, supply, and maintenance management. The FMF field hardened minicomputer is functionally equivalent to the Series I computer of the International Business Machine Corporation (IBM). However, because the IBM 4952 processor does not meet Marine Corps specifications, an IBM 4110 Display/Processor Unit is used. Currently the computer operates with 64KB of memory, has one built-in 9 inch video display screen, two 8-inch floppy disk drives, a detachable keyboard consisting of a standard typewriter keypad, a numeric keypad, and additional programmable function keys. The display holds 24 lines of 80 characters each which is the standard word processing format. The disk format is dual sided and double density so that the total storage available exceeds 2 megabytes.

The computer has been repackaged to withstand the rigors of field conditions. As a result, it has been given the official designation of Series I (R) for ruggedized. The components within the computer have been selected to operate at temperatures ranging up to 120 degrees and have been mounted to withstand vibration and shock. No humidity controls are required. Each unit contains fans operating through filters to maintain positive pressure and provide clean air inside the

cabinets so that the moving elements of the floppy disks are not contaminated. The computer should, however, be protected from excessive dust, and direct exposure to water. Each unit is provided with a fitted, sealed, and vented militarized shipping case for transport. The computer in its case weighs about 130 pounds and occupies a volume of about 5 cubic feet.

A dot matrix impact printer is part of the computer system. When operating with the computer, the printer is connected through a cable to one socket on the connector panel at the rear of the computer. The printer will produce 132 characters per line at a rate of 120 cps through 4 part paper. The printer is also provided with a similar shipping case for transport. When packed, it also weighs about 130 pounds and occupies the same amount of space as the computer.

Additionally, a limited number of other peripheral devices are available for the computer. Both connections and software are available for operating a 9-track magnetic tape unit and a paper tape punch with reader. Plugs or sockets for the magnetic and paper tape units are in the same rear panel through which the impact printer is connected. Also on this panel is a 25-pin "D" connector, which is commonly used for RS-232C communications. At this time, however, the RS-232C connector is not dedicated to any peripheral device. The present configuration of the Series I (R) does not include these auxillary input/output devices, and the computer used at the battalion level of the FMF consists only of the computer, dot matrix impact printer, and packing cases. All input modes and devices in the following discussion are RS-232C compatible and can, therefore, be used with the FMF computer if accompanied by proper software. Various data capture types, each with a brief description of how it would function in the medical setting, are presented in the following pages. Specific product descriptions for manufacturers of these devices and points of contact for the methods discussed are presented in Appendix II.

Machine Readable Information Direct to Computer

The most challenging problem for data capture is that of identifying a method of casualty identification that will work in the field environment. This mechanism must provide machine readable information and be one that will survive battlefield conditions, contain enough information to be medically useful, and be worn by the Marine in the field. Three technologies offer potential solutions: 1) magnetic stripe on plastic card, 2) alterable semiconductor memory encapsulated in a protective carrier, and 3) laser/optical memory cards.

Other machine readable coding methods are in widespread use. These include bar code, optical character recognition (OCR) printing, and magnetic ink printing. These machine readable forms may be too cumbersome for identification but may find use for other medical activities.

Magnetic Stripe

The magnetic stripe found on a bank card is a candidate for providing identification information on a casualty. The technology is well developed, and there are numerous sources for

cards and readers with RS-232C interfaces. The conventional magnetic stripe card contains three tracks for recording information with a total capacity of about 200 characters. Variations of the card made by a limited number of manufacturers can have capacities up to 1,000 characters. The reading of information from these types of cards is extremely reliable, since most data strings have associated error checking codes. Damage, however, might be done to the card in the field environment of dirt and moisture.

Magnetic stripe cards have been considered for patient identification at National Naval Medical Center, Bethesda, since 1977 (Borkat and Kataoka, 1977). Standard cards were purchased and were embossed and encoded for both inpatients and outpatients. Although suggestions were made for the information to be encoded on the cards, no standardization was provided for the cards, and no magnetic stripe reading capability was obtained.

Two other projects related to magnetic stripes for patient identification are currently being pursued by the Department of Defense. One is the Defense Enrollment Eligibility Reporting System (DEERS). This project attempts to standardize the medical eligibility information card so that with an automated registration system, a check can automatically be made on the eligibility of a patient whenever he or she tries to use a military medical treatment facility.

The second project is the Realtime Automated Patient Identification System (RAPIDS) with direction provided by the Naval Military Personnel Command. This project is an actual test of automated patient identification. At this time RAPIDS is undergoing tests at the medical activities in the Tidewater area of Virginia. Approximately 5,000 cards are being used and tested at the Little Creek Amphibious Base, VA and aboard the USS SAGINAW (LST-1188). Of the three tracks available on the standard magnetic stripe bank card, track one of about 79 characters is used for DEERS data. Only eligibility information is contained on the card. No patient medical information is being considered. The RAPIDS test should be completed by the end of 1983, and a report on the experience should be available in 1984.

There may be problems associated with this card when it is carried by a combat Marine in the field. When the card is carried in a wallet or purse, exposure to mechanical deformation and environmental hazards are minimal. In the field the card will not be so well protected. The part of the RAPIDS test aboard the USS SAGINAW (LST 1188) may give some indication of card reliability with rough handling. The information standardized by DEERS and tested in the RAPIDS projects will be useful for testing the value of machine readable information in a medical setting but may not demonstrate the reliability of the bank card style carrier for field use.

Alterable Semiconductor Memory

The technology for reading and writing information on alterable semiconductor memory is as mature as is that of magnetic stripes. Encapsulation into something that can be carried by a person, however, is relatively recent. In this technique erasable, programmable, read-only memories are covered with plastic so that the semiconductor is protected, but the electronic contacts are [illegible] Reading is performed by connecting the carrier to an electronic reader.

Capacities for these memory devices is quite large. Current sizes are 2,000 bits (about 250 characters) for one such device to about 64,000 bits (64K is about 8,000 characters) for advanced models of this device.

Two projects, both by the Army, are evaluating semiconductor memory for holding medical information. The first is part of the RAPIDS project and tests a 64K semiconductor memory placed on a plastic credit card holder. The holder also contains a microprocessor chip so that the combined memory and computer can be very flexible in manipulating data. This card is under test at Fort Lewis, WA. Only DEERS information is encoded on the card. Although space is available for health care information, use of the card for this purpose is not being tested. According to the contractor for this part of the RAPIDS project, these cards are expensive and are only available from foreign sources.

The second Army project has considerable promise for a field medical identification and information card. This is the Army Soldier Data Tag project under development at Fort Ben Harrison, IN. The semiconductor memory is encased in a durable plastic case that physically resembles the conventional dog tag. Electronic contacts are protected and available at the edges of the tag. This device should withstand some of the rigors of use in the field. Due to its physical resemblance to the conventional dogtag, it should be acceptably worn by a combat soldier.

The tag that the Army has been testing in the field has a capacity of only 2,000 bits. However, they expect to conduct a field exercise with a new tag which will have a capacity of 64,000 bits. The new tags will have both identification and health care information. A medical record of over 3,000 characters will be recorded for reading and display. The information in the soldier data tag covers identification, emergency, and administrative data. It also contains a subdivision for acute and chronic problems organized according to the Problem *Oriented Medical* Record format. In addition there are sections for spectacle prescription, immunization data and general remarks.

A field exercise with over 1,500 soldiers carrying the Army Soldier Data Tag will be conducted this October at Fort Ben Harrison, Indiana. The plan is to have simulated casualties during this test. As yet, there are no plans to read from the tags at a care echelon level below the field hospital, but there will be six microprocessors at the hospital. However, developers of the Soldier Data Tag have expressed interest in finding a hand-held terminal that can read the soldier data tag from somewhere in the field, probably from the evacuation vehicle. They want to spend no more than $2,000 for such a device which will then enable them to assemble medical records for forward transmission to the medical treatment facility.

Laser/Optical Memory Cards

In this new technology a laser is used to write onto a special optical recording material. The recording material can be encapsulated under a transparent protective layer of a credit card size carrier. The capacity of such a card would be more than 16,000,000 bits of data (2,000,000 characters). Data could be added to the card but not altered. Among the advantages of the laser

data card are that it does not wear out, and it is not susceptible to magnetic fields. As yet, however, none of these devices is available for evaluation.

Bar Code

Bar code is the most used and most reliable of the short string forms of data entry methods. Five schemes of bar coding are in common use. The Universal Product Code (UPC) found on most consumer items is one of the bar code forms. UPC, however, is a numeric only, as are most of the bar code types. The 3-of-9 code does allow for alpha numerics of 36 upper case letters, numbers and symbols, but it does require the most space at about 5 characters per inch. Thus, on a plastic card the size of a bank card, only about 15 characters and numbers could be encoded on any one line, and this would severely limit any field medical identification applications. It should be pointed out that bar code is not human readable, so that with the requirement for both human readable and machine readable code on a field medical card, bar code is even more restrictive.

Bar code is very reliable due to error checking digits that can be encoded in the data string. In grocery store check-out lines laser scanners read bar codes as the object bearing the code is passed over the fixed position scanner. Light pen wands are also used for bar code reading. In this case, the wand is passed over the object. Operator training for use of both reading devices is necessary to adjust for speed and position of the read scan, but this skill is quickly learned.

The bar code wand device is relatively small and is often designed for operating in areas where harsh treatment is common. Those devices designed to survive typical industrial operation conditions might also survive field use. Both fixed scanners and bar code wands can be obtained with RS-232 interfaces for direct connection to the IBM Series I (R).

The bar code scheme of data capture has, in fact, been used with the IBM Series I (R) by the Marine Corps. Commercial bar code wands as well as portable, down loadable units, all from the same manufacturer, were used at the 1982 Marine Corps Marathon to capture the finishing results. Both the wands and the down load units were interfaced through the RS-232 port. Assembly language programming was used to read from the bar code units. The bar code scheme used for number reading only was the interleaved 2-of-5.

Optical Character Recognition

Optical Character Recognition (OCR) is another form of encoding that is in widespread use. Initially, only a limited set of specially formed characters was used for OCR. With the advent of more powerful circuits and microprocessors for execution of pattern recognition algorithms, most printing fonts can now be read. Again, as with bar code, OCR codes require considerable space. Common typewriter characters are 10 or 12 characters per inch, which would translate to about 30 characters on a line for a bank style card. The conventional type face for bank cards is larger

than that of a typewriter, and only about 20 characters are actually used. OCR is both human and machine readable.

Two kinds of readers are available for OCR, page and document readers. Page readers are useful for entering previously typed text into a computer system. If conventional typed medical records are to be entered into the IBM Series I (R) on a large scale, an OCR machine, which has been reported to be able to keep up with 50 skilled typists, would be very useful. OCR readers, however, are very expensive. Document readers with wand scanners are used for reading short coded information strings. Like bar codes, they could be used for reading casualty identification number and for assisting with inventory control. Training for OCR wand use is also necessary, and OCR use is more sensitive to operator error than is use of the bar code. Also, OCR wands are more expensive than are bar code wands. Both page and wand document readers are available with RS-232 interfaces which would make them compatible with the IBM Series I (R).

Speech

Speech entry would be the ideal means of transferring information from a person to a computer because it would eliminate the considerable skills for keyboard entry and even the minimal training for bar code or OCR wand. Ideally, the vocabulary acceptable to the computer should match the words used in the environment. At this moment, however, speech input as a data capture method is limited to a few controlled activities. Most systems are speaker dependent. That is, in order for the machine to recognize a word, it must be trained by having the speaker repeat the word several times. Each user must train the system to his choice of words. Because of the size of the computing necessary for speech recognition, vocabularies of only about 200 words are in current use. Words when spoken must be separated in order to provide processing time for the computer, and this also contributes to the lack of widespread acceptance of speech as a means of data capture. Speech entry might also pose some additional problems in an area of high ambient noise--battlefield settings, for example.

It is difficult to keep current with advances in speech recognition as a means of data entry due to the tremendous research activity in this field.

Portable Terminals

Although the devices that might interface to the IBM Series I (R) for use in the medical setting are called terminals, they are basically portable, hand-held computers. These computers are battery powered, light weight devices that contain limited memory, minimal keypad, usually a single line of display, and one operating program. The terminals and the program within are designed to be the controller for one of the previously mentioned data capture devices (bar code wand reader, OCR wand or magnetic stripe reader). Their main function is to read and store the information obtained through use of the data capture device. After some limited number of

readings from the data capture device, the information is then down-loaded to a large stationary computer as a batch.

The portability of these devices is the critical feature. They can be moved to the source of the data, and this may be a necessity when obtaining information from a number of casualties. Rather than removing the machine readable medical tag from a casualty, moving it to the computer for reading, and returning it, which could result in some mix-up, the tag could be read while still attached to the casualty using a portable terminal. The original source of information need never be separated from the casualty.

While use of a portable terminal at the entry point of Echelon III is obvious, a portable terminal might be used at the exit point from Echelon II. In this setting the data from the casualty or from the group of casualties could be read, accumulated and forwarded via the RS-232C interface in preparation for arrival at Echelon III.

Some portable terminals are designed for operation in a dirty industrial environment, and might withstand the same harsh environmental conditions of Echelon III as the IBM Series I (R) but without any special ruggedization. And, they could possibly survive the Battalion Aid Station setting of Echelon II.

Although the IBM Series I computer appears to be the most likely candidate for implementing an automated casualty care system, some consideration should be given to the light-weight Digital Command Terminal (LDCT) developed by Litton Data Systems. The Marines have contracted for an initial delivery of 345 of these units. Each one weighs 32.5 pounds, has alphanumeric and graphic displays, can be connected to three peripheral devices at once, has up to six microprocessors, and 832 KB of RAM. Notice should also be taken of Litton Data Systems hand-held Digital Command Terminal (DCT). This device weighs less than 5 pounds, has full alphanumeric displays, graphics, 128 KB of memory, two-way communications, and message storage.

FMF COMPUTER SOFTWARE SUPPORT

At the time the ruggedized IBM Series I computer was purchased, a great deal of software was also acquired, but from sources other than IBM. The titles of the programs, although not entirely self-explanatory, indicate the types of functions for which the computer was selected. The list, as provided by the Information Services Management Office at Camp Pendleton in 1980, is as follows:

Unit Diary and Local Manpower Data Base

Allotment and Bond Authorization (ABA)

Transcription of Data Extraction System (TODES)

Pay Option Election System (POES)

Disbursing Officer Voucher (DOV)

Supported Activities Supply System (SASSY)

Marine Corps Integrated Maintenance Management System (MIMPS)

Unit Status and Identify Report (UNITREP)

Marine Corps Combat Readiness Evaluation System

(MCCRESSA)

Message Editing and Processing System (MEPS)

Military Pay List (MPL)

Military Pay Voucher (MPV)

Maintenance and Material Management (3-M)

Flight Readiness Evaluation Data System (FREDS)

Marine Air/Ground Financial Accounting and Reporting (MAGFARS)

Of the 64K of computer memory, the system operating program occupies 24 K. The programs listed above are read from one of the floppy disks into the remaining memory when needed. Data bases are also kept on floppy disk to be brought into the actual working space as required.

The primary programming language available for other applications is COBOL. After the initial software was acquired, additional major programming support has been provided by the individual Command Information Services Management Office at the request of a functional area. In addition, competent personnel from any unit can write their own software. The medical services have been particularly active in this area. For example, a Unit Commander's Medical/Dental system has been developed a Camp LeJeune, North Carolina, which allows medical personnel to record the immunization and dental status of troops in garrison.

Currently, a second language option more suitable for database management is being evaluated for the Series I computer because a casualty care system primarily involves interactive data storage, retrieval, and communication. The language under consideration is MUMPS, a high level ANSI standard language. MUMPS capability on the IBM Series I would allow software that has been developed for the Navy Occupational Health Information Monitoring System (NOHIMS) (Pugh and Beck, 1981; Beck and Pugh, 1982) to be adapted for the purpose of tracking battle casualties. Also, the possibility of adapting the Computer Stored Ambulatory Record (COSTAR) system to casualty care could be investigated. Moreover, new modules developed in MUMPS can take advantage of the extensive cross-referencing capability inherent in the language to connect data items in a meaningful way. This would facilitate tracking an individual as he was evacuated or could be used to immediately identify a blood source for a wounded Marine. Finally, this cross-referencing capability combined with the binary-tree search technique used in MUMPS makes it possible to retrieve individual records rapidly which is considered essential for a casualty care system. To illustrate one application of MUMPS to casualty care, the source code listing of a MUMPS program to compute the Trauma Score from the requisite vital signs is shown in Appendix III. Also shown is an example printout for a hypothetical casualty.

A MUMPS interpreter designed for use on the IBM Series I has been developed by LYCON Inc. Although the operating environment for this interpreter requires a minimum RAM of 128 KB and the ruggedized machine purchased by the Marine Corps only has 64KB, of RAM it is still being evaluated using an IBM Series I equipped with a 4955 processor and 128 KB of memory. It is felt that this evaluation is justified because the 4955 processor uses the same instruction set as the Marine

Corps machine and the original specifications for the Marine Corps machine stated that the processor should be expandable to 128 KB (Crago, 1981).

SYSTEM DESIGN

In light of the above discussion of the Marine Corps casualty care procedures and the available technology, there appears to be enough information to begin assembling an overall system for processing information to insure the continuity of care for combat casualties. Starting with an individual Marine we see the potential for a machine readable dogtag. Such a tag offers the potential of rapid identification in the field and the capacity for a greater amount of medical and personal history on the casualty. However, the implementation of this technology relies on automated systems functioning in garrison. First is the personnel system which accounts for each Marine and maintains the basic identifying and demographic data. Second is the medical system which operates as a satelite to the personnel system. The personnel system notifies the medical system of personnel additions or deletions whereupon individual records are created or deleted. When records are created, all data elements required by the medical system are supplied by the personnel system if they are available; all other elements are set to "unknown." When records are deleted, patient status reports are automatically generated in a form (printout, floppy disk, etc.) that can be forwarded with the Marine. Finally, whenever any data element in the medical system changes (e.g., "no allergies" might change to "allergic to penicillin") and that is an element included on the dogtag, then the medical system alerts the personnel system so that the individual's dogtag can be updated.

This system that supplies information for the dogtag would be used primarily for routine care in garrison. In that setting it would be capable of generating an Alpha Roster containing name, rank, social security number, date of birth, blood type, allergies, G6PD deficiency, PPD converter (T.B. test), physical examination frequency, and gas mask insert/eye glasses. Also, it should indicate the immunization status for smallpox, typhoid, tetanus, cholera, yellow fever, plague, polio, and influenza. The system would also identify individuals for dental recall with data elements indicating the individual's dental classification, when classification was assigned, date last seen by dentist, and the date fluoride treatment was last accomplished. In addition, the medical system would maintain other indicators of a Marine's deployability. For instance, those who have family conditions that would restrict their assignment would be tracked and data on mental patients would include their assigned location, type of care required, and the type of duties that can be performed. The system could also be used to track supplies.

In the field, sufficient information on the dogtag is human readable for the corpsman to be able to carry out his duties without the benefit of computer technology. However, the field medical card used by the corpsman would be redesigned to take advantage of the automated data input capability available at higher echelons. For example, site of injury might be indicated by a check mark that would be adjacent to a bar code that could be optically scanned.

At Echelon II two parallel systems are envisioned. One would be an expanded medical card or

data sheet. Again, this would be designed to take advantage of automatic input capabilities at higher echelons. The other would be a hand-held device that would be capable of reading the information electronically encoded on the dogtag. This device would also be able to 1) transmit information using specified radio frequencies, 2) encode additional information onto the dogtag, and 3) print data out on a paper tape. This latter capability is essential so that the casualty will always have a human readable record accompanying him.

The facilities at the third echelon, then, must be able to receive and interpret information encoded on the dogtag, information manually generated at Echelons I and II, as well as data transmitted or otherwise generated by the hand-held device that may be used at Echelon II. Of course, the information pertaining to treatments provided, etc., at Echelon III would be entered. With the data stored into the computer, various indices could be derived and used not only for patient care but also for resource management.

For the individual, a computer supplied with the appropriate set of vital signs could compute the Trauma Score and use it to assess his probability of survival. This assessment could be computed periodically to track the patient's status and monitor the effectiveness of the treatments provided. Or, the system could be used to alert medical personnel to a potential allergic reaction or drug interaction. Or, a potential blood donor could be located rapidly. Or, given symptomatology, routines developed for computer diagnosis could be implemented (Henderson, Robinson, Post, Decora, & Ryack, 1981). Also, for complicated or unusual procedures appropriate guidance could be retrieved.

For medical management, the system at echelon III could collate, format, and output a patient's data in a form suitable for inclusion in the permanent record. Also, reports could be produced for the Medical Regulating Agency specifying the number of casualties, diagnosis or types of wounds, and the Trauma Score data. These data would allow the Medical Regulating Agency to better organize and coordinate casualty evacuation.

The data gathered at Echelon III could also be used to estimate the amount of supplies consumed. Using information from a tri-service group formed for the purpose of standardizing the supplies and equipment for 307 of the most common wound and illness types encountered in Vietnam, estimates of the amount consumed could be derived from the casualty data recorded.

Personnel accounting is another function that could be integrated into the system at Echelon III. By integrating the casualty's identifier with manning tables, a list of the type of replenishments needed could be generated. The number and specialties of replacement personnel would be exactly equivalent to the losses.

A simplified schematic summarizing this system for casualty care is shown in Figure 2. In garrison are the personnel and medical systems which monitor the status of the troops. Periodically, the information the Marine is to carry into combat is encoded on the dogtag. This information may be read and augmented at the second and third echelons. Human readable data are used to initialize the data card completed by the corpsman in the field (Echelon I). At Echelon II data may be captured with a hand-written medical card or via a hand-held device. Printed output is always generated so that the casualty will be accompanied by a human readable record at

all times. When the casualty reaches Echelon III, all information is fed into a field computer which generates reports to be incorporated into the formal inpatient record to be sent to the Medical Regulating Agency and to be used for resupply and personnel accounting.

Epidemiology

In addition to contributing directly to medical and logistic support for the operating forces, a field medical information system can make possible important research, intelligence, and planning functions that were heretofore impossible. In the past the aggregation of medical data was too poorly organized and too slow to have any immediate value. Today with high speed computers epidemiological studies and rapid analyses of casualty and health delivery information could have a significant impact on ongoing combat operations and strategies. In the field specific data elements could be monitored to determine if any patterns were emerging that might indicate the use of biological weapons by the enemy or to identify potentially debilitating infectious disease before it spreads.

Papers by Joseph Henderson (1982 & 1983) show how epidemiological methods can be used in planning and establishing policy in the prevention, mitigation, and treatment of combat injuries. Because such studies would be observational and possible experimental interventions would be of limited scope under field conditions, causal inferences could not be easily made. However, if data elements were well defined and data gathering techniques were systematically built into the field medical information system, very useful assessments and interpretations of medical resource utilization and effectiveness could be made.

Coordination with Other Activities. The development of field medical data management capabilities must be coordinated with other Navy Medical Department and Department of Defense efforts so that the systems that are developed will have the commonality, consistency, and reliability required by forces operating jointly in the field. For example, the Navy is developing the Shipboard Non-Tactical Automation Program (SNAP) program for nontactical data uses (including medical). The FMF capabilities must be fully compatible with the Navy functions in order to ensure mutual supportability. SNAP capabilities (for both large and small vessels and units) are still under development, and the technical details of the two systems must be carefully coordinated if full compatibility is to be attained. Coordination of the FMF effort with Marine Corps and Navy user representatives would allow definition of capabilities compatible with SNAP. The NHRC parallel effort to develop the Naval Occupational Health Information Monitoring System, using the Computer Stored Ambulatory Record (COSTAR) software package, could be the basis for considerable interaction leading to highly compatible systems. Also, the Tri-Service Medical Information System (TRIMIS) is funding augmentation of COSTAR to include inpatient record capability. Close coordination of these efforts could lead to simplified, integrated, powerful capabilities that are consistent between the operating forces and fixed medical facilities. Such capability would allow the fixed facilities to absorb casualties from the operating forces through the evacuation chain with minimum difficulty and maximum flexibility.

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1 NAME / NOM PRENOMS

2 SERVICE NUMBER / NUMERO MATRICULE

3 GRADE / GRADE

4 NATION / NATIONALITE

5 FORCE / ARMEE

6 BRANCH AND TRADE / ARME (e.g. Infanterie)

7 UNIT / UNITE

8 SERVICE / DUREE DES SERVICES

9 AGE / AGE

10 RACE / RACE

11 RELIGION / RELIGION

12 FACILITY WHERE TAGGED / LIEU D ETABLISSEMENT DE LA FICHE

13 DATE AND HOUR TAGGED / DATE ET HEURE D ETABLISSEMENT DE LA FICHE

14 DIAGNOSIS / DIAGNOSTIC

15 LINE OF DUTY / EN RELATION AVEC LE SERVICE

NATURE OF CASUALTY OR ILLNESS / NATURE DE LA BLESSURE OU MALADIE		
DISABILITY / INCAPACITE	ENEMY ACTION / DU FAIT DE L'ENNEMI	
16 INJURY / BLESSURE	☐ YES / OUI	☐ NO / NON
17 SICK / MALADIE	☐ YES / OUI	☐ NO / NON

18 DATE & HOUR INJURED / DATE ET HEURE DE LA BLESSURE

19 WHAT WAS HE DOING WHEN INJURED / QUE FAISAIT-IL LORSQU IL FUT BLESSE

20 TREATMENT GIVEN / TRAITEMENT EFFECTUE

21 TOURNIQUET / MISE EN PLACE D UN GARROT

TREATMENT / TRAITEMENT EFFECTUE	a DOSE / DOSE	b HOUR AND DATE / HEURE - DATE
22 MORPHINE- 1st / MORPHINE- 1ere		
23 MORPHINE- 2nd / MORPHINE- 2eme		
24 MORPHINE- 3rd / MORPHINE- 3eme		
25 TETANUS TOXOID / VACCIN ANTITETANIQUE		
26 A.T. SERUM/SERUM ANTITETANIQUE		

27 DISPOSITION-DISPOSAL / DESTINATION DONNEE AU BLESSE

28 HOUR AND DATE / HEURE ET DATE

29 MEDICAL OFFICER / SIGNATURE ET GRADE DU MEDECIN

DD FORM 1380, 1 JUN 62

U. S. FIELD MEDICAL CARD/FICHE MEDICALE DE L'AVANT ETATS-UNIS

S/N 0102-LF-013-3500

30 a ABSOLUTION / CONFESSION

b HOLY COMMUNION / SAINTE COMMUNION

c EXTREME UNCTION / EXTREME ONCTION

d OTHER MINISTRATIONS / AUTRES MINISTERES

e CHAPLAIN / SIGNATURE DE L AUMONIER

31 DIET / REGIME ALIMENTAIRE

☐ REGULAR / NORMAL ☐ LIQUID / LIQUIDE ☐ NOTHING BY MOUTH / RIEN PAR VOIE ORALE

32 REMARKS / REMARQUES

★ U S GOVERNMENT PRINTING OFFICE 1982-509 502

Figure 1

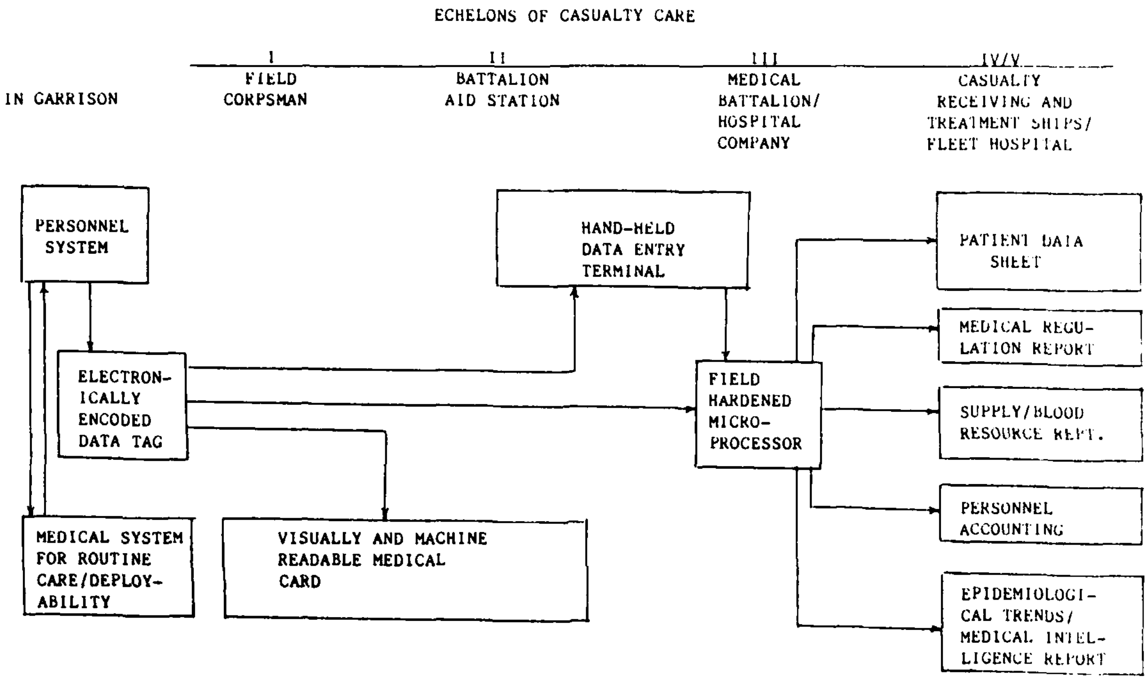
ECHELONS OF CASUALTY CARE
I
FIELD CORPSMAN
II
BATTALION AID STATION
III
MEDICAL BATTALION/ HOSPITAL COMPANY
IV/V
CASUALTY RECEIVING AND TREATMENT SHIPS/ FLEET HOSPITAL
IN GARRISON
PERSONNEL SYSTEM
HAND-HELD DATA ENTRY TERMINAL
PATIENT DATA SHEET
MEDICAL REGU-LATION REPORT
ELECTRON-ICALLY ENCODED DATA TAG
FIELD HARDENED MICRO-PROCESSOR
SUPPLY/BLOOD RESOURCE REPT.
PERSONNEL ACCOUNTING
MEDICAL SYSTEM FOR ROUTINE CARE/DEPLOY-ABILITY
VISUALLY AND MACHINE READABLE MEDICAL CARD
EPIDEMIOLOGI-CAL TRENDS/ MEDICAL INTEL-LIGENCE REPORT

Figure 2

APPENDIX I

COMBAT MEDICAL RECORD

DATA ELEMENTS	IN GARRISON	ECHELONS		
		ECHELON I	ECHELON II (BAS)	ECHELON III
IDENTIFICATION DATA				
Name	Recorded Data Tag	Required Information	Required Information	Required Information
SSN/Family Member Prefix	↓	Required Information	Required Information	Required Information
Date of Birth		Optional Information	Optional Information	Optional Information
Sex		Optional Information	Optional Information	Optional Information
DEMOGRAPHIC DATA				
Paygrade or Rank	Recorded Data Tag	Optional Information	Optional Information	Optional Information
Country	↓	↓	↓	↓
Branch of Service				
Race				
Religion				
BRIEF MEDICAL HISTORY				
Allergies (Most Recent)	Recorded Data Tag	Required Information	Required Information	Required Information
Blood Type	↓	Optional Information	Optional Information	Required Information
Immunization Status (Smallpox, Typhoid, Tetanus, Cholera, Yellow Fever, Plague, Polio, Influenza)		Optional Information	Optional Information	Optional Information
Heart Irregularity		Required Information	Required Information	Required Information
Unequal Pupils Normal		Required Information	Required Information	Required Information
VITAL SIGNS				
Temperature			Repeated Measurements Recorded Along with Time (Date/Hour/Min)	Repeated Measurements Recorded Along with Time (Date/Hour/Min)
Pulse			↓	↓
Respiratory Rate				
Respiratory Effort (Expansion)				
Systolic Blood Pressure				
Diastolic Blood Pressure			Not Measured at Ech II Repeated Measurements Recorded Along with Time (Date/Hr/Min)	
Verbal Response: 1-Oriented, 2-Confused, 3-Inappropriate Words, 4-Nonunderstandable, 5-None				
Eye Opening: 1-Spontaneous, 2-To Voice, 3-To Pain, 4-None				
Motor Response: 1-Obeys Commands, 2-Withdrawal, 3-Flexon, 4-Extension, 5-None				

DATA ELEMENTS	IN GARRISON	ECHELON I	ECHELONS ECHELON II (BAS)	ECHELON III
Capillary Refill:				
1-Less than 2 Sec.				
2-2 Secs. or Greater				
Mental Status Exam		Abbreviated Exam Recorded	Further Description Recorded	Mental Status Exam Recorded
Glascow Coma Scale: Scale		Recorded Along with Time (Date/Hr/Min)	Repeated Measurements	Repeated Measurements
Trauma Score/ Probability of Survival			Recorded Along with Time (Date/Hr/Min)	Recorded Along with Time (Date/Hr/Min)
Triage Category:			Optional Measurement	Recorded
1-Minimal				
2-Delayed				
3-Immediate				
4-Expectant				
Provider I.D.		Recorded	Recorded	Recorded
Facility No.			Recorded	Recorded
<u>INJURIES</u>				
Time of Injury (Date/Hr)		Recorded	Further Description Recorded	Further Description Recorded
Body Part				
Type of Injury:				
Dislocation				
Fracture				
Laceration				
Puncture				
Traumatic Amputation				
Wound				
Burns: 3°___ 2°___ 1°___				
<u>MEDICATIONS</u>				
Narcotics: Morphine		Recorded (Dose and Times (Date/Hr/Min)	Recorded (Dose and Times (Date/Hr/Min)	Recorded (Dose and Times (Date/Hr/Min)
Antibiotics:				
Penicillin				
Sulfa				
Antidotes:				
Atropine				
Immunizations:				
Tetanus:				
Toxoid				
Vaccine				
Serum				
Other (Specify)				
Route of Amdinistration				
Provider I.D.				
Facility No.				
Anti-arrhythmics				
Pre-op. Medications				
<u>PROCEDURES</u>				
Tourniquet		Time (Date/Hr/Min) Applied & Removed Recorded	Time (Date/Hr/Min) Applied & Removed Recorded	Time (Date/Hr/Min) Applied & Removed Recorded
Splints		Type & Location Recorded	Type & Location Recorded	Type & Location Recorded
Bandages		Recorded	Recorded	Recorded
Tracheotomy		Recorded	Recorded	Recorded
Tubes (Endotrachial, chest, NG, Foley Catheter)			Type Recorded	Type Recorded
Casting/Immobilization:			Recorded	Recorded

DATA ELEMENTS	IN GARRISON	ECHELON I	ECHELONS ECHELON II (BAS)	ECHELON III
Body Part				
Method				
IV Solutions:				
Ringers Lactate			Recorded	Recorded
Normal Saline				
D5W				
Other (Specify)				
Time Started				
Location				
Gauge Needle				
Sutures			Recorded	Recorded
Blood Transfusions				Recorded
Oxygen Administration:				
Time started				
%				
X-ray:				
Location				
Views				
Diet				
Other (specify)				
Provider I.D.		Recorded	Recorded	Recorded
Facility No.			Recorded	Recorded
PRESENTING PROBLEMS				
Problem List			Problem list Recorded	Problem List Recorded Chart of Body Parts and Organs Marked as to What and Where
Provider I.D.			Recorded	Recorded
Facility No.			Recorded	Recorded
PATIENT MANAGEMENT AT ECHELON III				
Received by:				
Air				Recorded
Boat				
Field Litter				
Ambulance				
Time of Arrival				
Time Seen				
Time into OR				
Facility No.				
TRIAGE DISPOSITION AT ECHELON III				
Morgue				Recorded
X-ray				
OR (Major Surgery)				
OR (Minor Surgery)				
ICU				
Decontamination Treatment				
Primary Ward				
Overflow Ward				
Triage Medical Officer I.D.				
Facility No.				
LABORATORY TESTS				
Type of Test:				
CBC				Tests Ordered and Recorded
Urinalysis				
Blood Type & Crossmatch				
Electrolytes				
Blood Gases				

DATA ELEMENTS	IN GARRISON	ECHELON I	ECHELONS ECHELON II (BAS)	ECHELON III
Culture:				
Sputum				
Stool				
Throat				
Urine				
Wound				
Other (Specify)				
Other (Specify)				
Result(s)				
Organism I.D.				
Resistance Pattern				
Attribute Pattern				
Provider I.D.				Recorded
Facility No.				Recorded
<u>OPERATIVE PROCEDURE</u>				
Time (Date/Hr/Min)				Recorded
Type of Procedure:				
R-Repair				
D-Debride				
X-Excise				
P-Amputate				
O-other (Specify)				
Chart of Body Parts and Organs				
Marked for Location of Procedure				
Anesthetic Type				
<u>General</u>				
H-Halothane				
E-Ether				
N-Nitrous Oxide				
<u>Regional</u>				
SAB - Saddle Block				
EPDL - Epidural				
AX - Axillary				
IV - Intravenous				
<u>Field</u>				
Xylocaine:				
With epinephrine				
Without epinephrine				
Pontocaine				
Administration Time (Date/Hr/Min)				
Special Procedures (Text)				
Remarks (Text)				
Intensive Care:				
Time (Date/Hr/Min)				
Summary (Text)				
Medical Officer I.D.				Recorded
Surgeon I.D.				
Facility No.				
<u>PROVIDER ORDERS/NOTES</u>				
Orders				Recorded
Provider I.D.				
Notes				
Provider I.D.				
Summary (Test)				
Facility No.				

DATA ELEMENTS	IN GARRISON	ECHELON I	ECHELONS ECHELON II (BAS)	ECHELON III
FINAL DISPOSITION FROM ECHELON II				
Treated and Returned				
to Field			Recorded	
Evacuated by:				
Air				
Boat				
Field Litter				
Ambulance				
Died of Wounds				
Other (Specify)				
Medical Officer I.D.				
Facility No.				
FINAL DISPOSITION FROM ECHELON III				
Treated and Returned				
to Field				
Evacuated by:				Recorded
Air Vehicle				
Land Vehicle				
Sea Vehicle				
Died of:				
Battle Injuries				
Non-battle Injuries				
Burns				
Chemical				
Disease				
Suicide				
Other (Specify)				
Other (Specify)				
Medical Officer I.D.				
Facility No.				

APPENDIX II
PRODUCT DESCRIPTION

MAGNETIC STRIPE

TECHNOLOGY

Strips of magnetic recording material are embedded in plastic cards. The specifications are detailed in ANSI X4.16-1976. Three tracks are commonly used, each for different institution as follows: International Air Transportation Association (IATA). Track 1 with 79 alphanumeric characters; American Banker Association (ABA), track 2 with 40 numeric characters; Thrift Industry (Thrift), track 3 with 107 numeric characters. In most instances only track 3 is read-write. Many commercial facilities are available to the banking industry, as one example, for embossing and encoding information onto track 1.

SOURCES

American Magnetics Corporation
740 Watsoncenter Road
Carson, CA 90745
213/775-8651

Manufacturer of slide through stripe readers and encoders.

Arthur Blank & Co., Inc.
119 Braintree Street
Boston, Mass 02134
617/254-4000 or 800/225-4375
Margarett M. Henley

Manufacturer and encoder of plastic credit cards.

International Plastic Cards, Inc.
5335 West 146th Street
Lawndale, CA 90260
213/970-0812
John Rosso, President

Manufacturer and encoder of plastic credit cards.

Magtek
20725 S. Annalee Avenue
Carson, CA 90746
213/631-8602
Ruth Barker, Marketing Manager

Manufacturer of stripe encoders and readers.

The Silcocks Miller Company
310 Snyder Avenue
Berkeley Heights, NJ 07922
201/665-0300

PORTABLE TERMINALS THAT INTERFACE TO THE COMPUTER

TECHNOLOGY

These are light weight, portable, battery powered, devices generally with a single line of display, a small multi-use keypad and one attached data capture device. They usually contain one fixed function program to read and store the information into a small size memory from the data capture device and to down-load it through an RS-232 interface to a larger computer on request.

SOURCES

Azurdata, Inc.
1110 Olive
Huntington Beach, CA 92648
714/498-1154
Roger S. Oakes, District Sales Manager

Manufacturer of portable terminal with bar code wand and acoustic coupler. RS-232 interface

available.

Data Transfer, Inc.
1302 Equestrian Avenue
Thousand Oaks, CA 91360
805/497-8447

Manufacturer of portable terminal with bar code wand and up to 120 Kbyte of memory. Has RS-232 Interface. Magnetic card reader is additional option. Programmable in BASIC.

Digitronics
Division of Comtec Information Systems, Inc.
53 John Street
Cumberland, RI 02864
401/724-8500

Manufacturer of portable terminals with OCR wand reader and RS232 interface. Bar code input also available.

Epic Data
7280 River Road
Richmond, B. C., Canada V6X 1X5
604/273-9146

Manufacturer of portable terminals with bar code wand readers, magnetic stripe readers and RS-232 interfaces.

Interface Mechanism, Inc.
4405 Russell Road, P. O. Box N
Lynwood, Wash. 98036
206/743-7036

Manufacturer of portable terminals with bar code wand readers.

OPTICAL CHARACTER RECOGNITION

TECHNOLOGY

Formed, human readable characters are read by passing a reading device over the letters. A number of special fonts are used for the characters, but these type faces are available for conventional Selectric typewriters or printers.

SOURCES

Caere Corporation
100 Cooper Court
Los Gatos, CA 95030
408/395-7000

Manufacturer of OCR wand, pass through readers and decoders with RS-232 interfaces for 6 typefaces.

Cognitronics Corporation
1741 Loretta Avenue
Feastreville, PA 19047
215/673-5544
D. Clark Murphy, VP, Contract Sales

Manufacturer Of OCR document readers.

Recognition Equipment Incorporated
OCR Wand Products Division
P. O. Box 22307
Dallas, Texas 75222
214/579-6000
Charlotte L. Robertson, Manager, Promotions/Merchandising

Manufacturer of OCR wand, pass through readers and decoders with RS-232 interfaces for a number of typefaces.

Scan-Data Corporation
800 East Main Street
Norristown, PA 19401
215/277-0500
Harry A. Dorn, Director of Marketing

Manufacturer of high speed page and document readers for OCR.

Intertelephone USA, Inc.
1200 Levin Avenue
Mountain View, CA 94040

415/979-3175

Represent Brondi S.p.A (Italy) Manufacturer of bar code wand readers.

Welch Allyn, Inc.
Industrial Products Division
Jordan Road
Skaneateles Falls, NY 13153-0187
315/685-8351
C. M. Crowther, Industrial Sales

Manufacturer of bar code wands and decoders.

BAR CODE

TECHNOLOGY

Fixed width mix of black and white stripes are read by passing a light source and sensor over them. The electronics decodes the sequence of stripes into either numbers or letters and numbers. The technique accomodates variable rates of reading from either direction. It also has error checking codes built into the data stream. Many bar code schemes are available.

SOURCES

Computer Identics Corporation
5 Shawmut Road
Canton, Mass 02021
617/821-0830

Manufacturer of bar code wand and slot readers, scanners and electronics. Some readers are ruggedized for harsh environments.

Fuller Engineering & Manufacturing, Inc.
P. O. Box 26710
Parkmoor Station
San Jose, CA 95159
408/946-1188

Manufacturer of bar code scanners.

Hewlett Packard Components
640 Page Mill Road
Palo Alto, CA 94304

Manufacturer of bar code wands. Their products are incorporated into integrated reading devices of other manufacturers.

Identicon Corporation
One Kenwood Circle
Franklin, Mass 02038
617/528-6500 or 800/343-0881
Patricia R. Brendle, Sales Administrator

Manufacturer of bar code wands and terminal stations.

Interface Mechanism, Inc.
4405 Russell Road, P. O. Box N
Lynwood, Washington 98036
206/743-7036

Manufacturer of bar code wand readers, printers and electronics.

LASER/OPTICAL MEMORY CARDS

TECHNOLOGY

Using lasers, submicron holes are melted in a photolithographic medium. The density of the holes allows for the recording of high volumes of data on a small surface. For a medical record, for example, a bank card size carrier using a single stripe of sensitive material the size and position of the current magnetic stripe could hold over 5 million bits of information. This is primarily a read only storage medium.

SOURCES

Drexler Technology Corporation
2557 Charleston Road
Mountain View, CA 94043
415/979-7277

ALTERABLE SEMICONDUCTOR MEMORY

TECHNOLOGY

Semiconductor memories, usually of the read only (ROM) type or erasable, reprogrammable read only (EPROM), common to computer technology are used. Current integrated circuit technology allows for up to 64K of memory on one device.

SOURCES

Datakey, Inc.
12281 Nicollet Avenue
Burnsville, MN 55337
612/890-6850
William Flies, Chairman

EPROM in plastic case. Available memory sizes of 2K and 64K

Honeywell Information Systems
P. O. Box 23056
San Diego, CA 92123-0056
619/292-5311 Ext 261
R. H. Trimmins, Senior Account Representative, Federal Systems Division

EPROM and microprocessor on bank card size plastic.

J. H. Herslow, Vice President

Manufacturer of plastic credit cards.

MSI Data Corporation
340 Fischer Avenue
Costa Mesa, CA 92626
619/549-6000
Bob Bohle, Market Specialist

Manufacturer of portable terminals with bar code scanning input.

North American Micronics, Inc.
P. O. Box 488
San Clemente, CA 92672
714/496-9387
Samuel B. Dishman, National Sales Manager

Manufacturer of portable terminals with bar code wand readers. RS-232 interface or acoustic coupler available.

Telxon Corporation
3330W Market Street
Akron, Ohio 44313
216/876-3700 or 800/321-2424
Richard J. Gurda, Director of Marketing

Manufacturer of portable terminal with optional bar code scanner and acoustic coupler.

Termiflex Corporation
18 Airport Road
Nashua, NH 03063-1797
603/889-3883
Richard S. Mizia, Regional Manager

Manufacturer of portable terminals with RS-232 interface. No data capture devices listed as options.

MILITARY USES OF DATA CAPTURE DEVICES AND TECHNOLOGIES

ARMY SOLDIER DATA TAG

This project is being done for the Director of Combat Development of the Soldier Support Center. Source of information is Major Gary Lacher, Fort Ben Harrison, IN, AV 699-3799 or Major Ken Rose AV 699-3782 or 3799.

The device that they use for the soldier data tag is a commercial device that was originally designed to be an electronic key for secure systems. It has a semiconductor memory within a "key" shaped plastic covering. For the Soldier Data Tag Project the memory has been repackaged to look like a dog tag. In the memory will be a medical record of 3000 characters long on 7 "screens". They use a problem oriented medical record on the tag. The seven screens recorded on the EPROM are as follows:

1) Emergency data

2) Administrative Data
3) Medical Record Screen
   POMR
   Acute problems
   Chronic problems
4) Spectacle prescription
5) Immunization Data
6) Remarks
7) ?

Some of the data, like nuclear readiness and qualification, will have to be erased.

The software to read the tag is in Pascal MT, but shortly will be in UCSD Pascal (by Sept 15 from contractor). They plan to have about 6 microprocessors in the field hospital to read the soldier data tag. They use a Microsource Computer to read the tag and display.

The biggest problem right now is converting paper record to data that can be recorded on the soldier data tag. The procedure is to have someone look through the big paper record and cull out those data necessary for the tag. They expect to do this for the 1500 soldiers who will be participating in the test in October.

Another problem is identifying a hand-held terminal that can read the soldier data tag somewhere in the field, for example, in the back of an evac vehicle. They want to spend no more than $2,000 for the device which will enable them to assemble records for forward transmission to the medical treatment facility.

The field test of the soldier data tag using 1500 soldiers with simulated casualties should take place on or after October 31. It will be at Fort Ben Harrison near Indianapolis, IN. It was suggested that someone from the Navy Medical and Personnel Commands be there to observe. They would like to field the dog tag by October 1984.

The Academy of Health Sciences is very supportive of the work as is the current Army Surgeon General, Maj Gen French, who was at the Academy until recently.

The vendor for the Soldier Data Tag is

DATAKEY, Inc.
12281 Nicollet Avenue
Burnsville, MN 55337
612/890-6850 or 800/328-8828
Bill Flies, President

UNIFORMED SERVICES IDENTIFICATION CARD

This work is a Tri-Services Medical Information System (TRIMIS) project under the direction of the Army. Col Michael Gilmartin is the Army Rapids Project Manager.

This project is entitled the Realtime Automated Patient Identification System with the acronym RAPIDS. It is under test in some Navy Medical facilities for identification of patients. It is being examined at the Little Creek Amphibious Base, Norfolk, VA, and aboard the USS Saginaw (LST 1188). This test uses magnetic stripe bank type cards for patient identifications. Only track 1, of 79 alphanumeric characters, is used. Thirty data elements are recorded on the track. When read, this is compared against the Defense Enrollment Eligibility Reporting System (DEERS) data of the test site microcomputer.

Also being considered is the microchip card of Phillips Data of France. This method provides 16K bits of data, but it uses 6 bit bytes, so encoding may not be standard. Technicalities of the microchip system can be obtained from the Navy Project Manager at Naval Military Personnel Command (NMPC), LCDR Roger Schultz, AV 225-0039.

Prime contractor for the RAPIDS Project is:

Input/Output Computer Systems
4340 East West Highway
Suite 50
Bethesda, MD 20814
301/656-1080
Mr. George Blick

Input/Output Computer Systems is using two types of cards, the mag stripe and the microchip. Magnetic stripe is conventional bank card type of which they use only track one of about 79 characters. On this they encode the information needed for the DEERS data base. The microchip has a 16K memory plus a microprocessor that can add and subtract both on the card. The microchip card is made in France by Phillips International. Each microchip card cost about $25. The microchip card is being tested by the Army at FT LEE, VA.

The magnetic card test will produce about 5,000 to 10,000 cards in the Little Creek and USS Saginaw tests. The test is underway now, and should be finished by the end of the year. There should be a completed report delivered to LCDR Schultz by the end of March 1984.

The Army Food Management has expressed an interest in using one track of the card for some of their activities.

MARINE CORPS MARATHON BAR CODE

This work was performed by the Information Systems Management Office at Quantico Marine Corps Education and Development Center, Systems Development Branch. Source of this information was Staff Sgt Thompson (AV 278-3329). Further questions should be directed to Maj John Keene at the Development Center, Quantico (AV 278-3350 or 703/640-3350).

On orders of the Commandant, this group interfaced a bar code reader in two different forms to handle the Marine Corps Marathon of 1982. They bought a number of portable bar code readers from computer Identics of Westwood MA. They also bought a number of down load units. Baud rates for the bar code read was 1200. They used an interleaved 2 of 5 code.

These were connected to the IBM Series I (R) through the RS-232 connecter. They also added a second asychronous board to the computer in order to have two of the computers talk to each other. In actuality, the connector on the rear of the computer is not connected to anything internally, but it can be simply plugged into a free hanging connector.

They had to write some assembly language programs to handle both the I/O ports. The standard port, 08, was used and a second port, 09, was also used. Although assembly language was needed to handle both ports, Staff Sgt Thompson thought that the available EDL language could handle the standard single I/O port.

Bar Code Source:

Computer Identics
31 Dartmouth Street
Westwood, MA 02090
617/821-0803
Contact: Don Way

APPENDIX III

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TRMSCR  ;MWC;17SEP83;TRAUMA SCORE (MAIN OPTION DRIVER)
        W !,?20,"U.S. NAVY TRAUMA SCORE EVALUATION PROGRAM",!,?26,"NAVAL HEALTH
RESEARCH CENTER",!,?35,"SAN DIEGO, CA",!!!!!!!!!!!!!!!!!!
        S EXIZ=9,NL=7,LEN=35,COLS=2,PDV=$10
FN      R !!!,"SELECT OPTION ('?' FOR HELP) > ",FN G END:FN=""
        F I=0:1 Q:$T(TABLE+I)=""  G FOUND:$F($P($T(TABLE+I),";",2),FN)-1=$L(FN)
        W "?" G FN
        ;
END     K I,FN,EXIZ,LN,LEN,COLS,PDV
        W !!,"*** FINISHED ***" Q
        ;
FOUND   S X=$T(TABLE+I) W $E($P(X,";",2),$L(FN)+1,99),!
        X $P(X,";",3) G FN
        ;
QUES    W ! F I=1:1 Q:$T(TABLE+I)=""  W ?10,$P($T(TABLE+I),";",2),!
        Q
        ;
TABLE   ;?;D QUES
        ;A. OPERATIONAL DEFINITIONS OF TRAUMA SCORE;D ^TRMDEF
        ;B. COMPUTATION OF TRAUMA SCORE AND PERCENTAGE SURVIVAL;D ^TRMCMP

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TRMDEF  ;MWC;17SEP83;OPERATIONAL DEFINITIONS OF TRAUMA SCORE
        W !!!,?18,"*** OPERATIONAL DEFINITIONS OF TRAUMA SCORE ***"
        W !!,?5,"THE TRAUMA SCORE IS A NUMERICAL GRADING SYSTEM FOR ESTIMATING T
HE ",!,"SEVERITY OF A BLUNT OR PENETRATING INJURY."
        W "  THE SCORE IS COMPOSED OF THE",!,"GLASGOW COMA SCALE AND MEASUREMENT
S OF CARDIOPULMONARY FUNCTION."
        W !,?5,"EACH PARAMETER IS GIVEN A NUMBER (HIGH FOR NORMAL AND LOW FOR IM
PAIRED",!,"FUNCTION).  SEVERITY OF INJURY IS ESTIMATED BY SUMMING THE NUMBERS.
"
        W !,"THE LOWEST SCORE IS '1', AND THE HIGHEST SCORE IS '16'."
RR      W !!,"RESPIRATORY RATE (NUMBER OF RESPIRATIONS IN 15 SECONDS MULTIPLIED
BY FOUR)",!,?2,"RATE",?17,"SCORE (TRAUMA)",!,"10-24/MIN",?19,"4",!,"24-35/MIN",?
19,"3",!,"36/MIN OR GREATER",?19,"2",!,"1-9/MIN",?19,"1",!,"NONE",?19,"0"
RE      W !!,"RESPIRATORY EXPANSION",!,?5,"NORMAL (NORMAL RESPIRATORY EXPANSION)
",!,?5,"REFRACTIVE (USE OF ACCESSORY MUSCLES OR INTERCOSTAL MUSCLE RETRACTION)"
        W !,?2,"EXPANSION",?17,"SCORE (TRAUMA)",!,"NORMAL",?19,"1",!,"REFRACTIVE
",?19,"0"
CQ      R !,?5,"C(ONTINUE) OR Q(UIT) > ",A
        G:A=("Q")!("") FN^TRMSCR
SBP     W !!,"SYSTOLIC BLOOD PRESSURE (CUFF PRESSURE)",!,?5,"BLOOD PRESSURE IS T
AKEN IN EITHER ARM (AUSCULTATION OR PALPATION TECHNIQUE)"
        W !,?1,"PRESSURE",?17,"SCORE (TRAUMA)"
        W !,"90MM HG OR HIGHER",?19,"4",!,"70-89MM HG",?19,"3",!,"50-69MM HG",?1
9,"2",!,"0-49MM HG",?19,"1",!,"NO PULSE",?19,"0"
CAPR    W !!,"CAPILLARY REFILL",!,?5,"NORMAL (NAIL BED, FOREHEAD, OR LIP MUCOSA
COLOR REFILL IN 2 SECONDS)",!,?5,"DELAYED (MORE THAN 2 SECONDS CAPILLARY REFILL)
",!,?5,"ABSENT (NO CAPILLARY REFILL)"
        W !,?2,"REFILL",?17,"SCORE (TRAUMA)",!,"NORMAL",?19,"2",!,"DELAYED",?19,
"1",!,"ABSENT",?19,"0"
EYEO    W !!,"EYE OPENING (SPONTANEOUS,TO VOICE, TO PAIN, NONE)",!,?2,"CONDITION
",?17,"SCORE (GLASGOW COMA SCALE)",!,"SPONTANEOUS",?19,"4",!,"TO VOICE",?19,"3",
!,"TO PAIN",?19,"2",!,"NONE",?19,"1"
CCQ     R !,?5,"C(ONTINUE) OR Q(UIT) > ",B
        G:B=("Q")!("") FN^TRMSCR
VERBR   W !!,"VERBAL RESPONSE (AROUSES WITH VOICE OR PAINFUL STIMULUS)",!,?2,"RE
SPONSE",?22,"SCORE (GLASGOW COMA SCALE)",!,"ORIENTED",?24,"5",!,"CONFUSED",?24,"
4",!,"INAPPROPRIATE WORDS",?24,"3",!,"INCOMPREHENSIBLE WORDS",?24,"2",!,"NONE",?
24,"1"
MOTR    W !!,"MOTOR RESPONSE (RESPONDS TO COMMAND OR PAINFUL STIMULUS)",!,?2,"RE
SPONSE",?17,"SCORE (GLASGOW COMA SCALE)",!,"OBEYS COMMAND",?19,"6",!,"LOCALIZES
PAIN",?19,"5",!,"WITHDRAWS TO PAIN",?19,"4",!,"FLEXION TO PAIN",?19,"3"
        W !,"EXTENSION TO PAIN",?19,"2",!,"NONE",?19,"1"
CONV    W !!,"CONVERT GLASGOW SCORE TO TRAUMA SCORE:  ",?40,"GLASGOW SCORE",?57,
"TRAUMA SCORE",!,?43,"14-15",?62,"5",!,?43,"11-13",?62,"4",!,?43," 8-10",?62,"3"
,!,?43," 5- 7",?62,"2",!,?43," 3- 4",?62,"1"
CCCQ    R !,?5,"C(ONTINUE) OR Q(UIT) > ",D
        G:D=("Q")!("") FN^TRMSCR
LAST    W !!,?5,"PROJECTED ESTIMATE OF SURVIVAL FOR EACH VALUE OF THE TRAUMA SCO
RE BASED",!,"ON RESULTS FROM 1,509 PATIENTS WITH BLUNT OR PENETRATING INJURY.",!
!,?20,"TRAUMA SCORE",?40,"PERCENTAGE SURVIVAL",!!,?25,"16",?48,"99"
        W !,?25,"15",?48,"98",!,?25,"14",?48,"96",!,?25,"13",?48,"93",!,?25,"12"
,?48,"87",!,?25,"11",?48,"76",!,?25,"10",?48,"60",!,?25," 9",?48,"42",!,?25," 8"
,?48,"26",!,?26,"7",?48,"15"
        W !,?26,"6",?49,"8",!,?26,"5",?49,"4",!,?26,"4",?49,"2",!,?26,"3",?49,"1
",!,?26,"2",?49,"0",!,?26,"1",?49,"0"
        R !!!,"RETURN TO MAIN MENU? (Y OR N) > ",E
        G:E?1"Y" FN^TRMSCR
        G:E?1"N" END^TRMSCR
        G:E'=("Y")!("N") LAST+3
        E  G END^TRMSCR

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TRMCMP  ;MWC;17SEP83;COMPUTATION OF TRAUMA SCORE AND PERCENTAGE SURVIVAL
        W !!!,?5,"THIS PROGRAM CALCULATES THE PROJECTED ESTIMATE OF SURVIVAL FOR
",!,"INDIVIDUALS SUFFERING FROM BLUNT OR PENETRATING INJURIES BASED ON THE GLASG
OW",!,"COMA SCALE."
NAME    R !!,"NAME (LAST,FIRST MI)? > ",NAM
        W:NAM'?.U1",".U.E !,"INVALID NAME FORMAT" G:NAM'?.U1",".U.E NAME
RESPR   R !!,"RESPIRATORY RATE (NUMBER OF RESPIRATIONS IN 15 SECS)? > ",RR
        W:RR'?1N&(RR'?2N) !,"INVALID RESPONSE"
        G:RR'?1N&(RR'?2N) RESPR
        S RRA=RR*4 S:(RRA>9)&(RRA<25) RRS=4 S:(RRA>24)&(RRA<36) RRS=3 S:(RRA>35)
 RRS=2 S:(RRA>0)&(RRA<10) RRS=1 S:RRA=0 RRS=0
RESPE   R !!,"RESPIRATORY EFFORT 'N(ORMAL) OR R(EFRACTIVE)' > ",RE
        W:RE'?1"N"&(RE'?1"R") !,"INVALID RESPONSE (TYPE 'N' OR 'R')"
        G:RE'?1"N"&(RE'?1"R") RESPE
        S:RE="N" RES=1 S:RE="R" RES=0
SBP     R !!,"SYSTOLIC BLOOD PRESSURE (EITHER ARM, AUSCULTATE OR PALPATE) > ",SB
P
        W:SBP'?1N&(SBP'?2N)&(SBP'?3N) !,"INVALID RESPONSE"
        G:SBP'?1N&(SBP'?2N)&(SBP'?3N) SBP
        S:SBP>89 SBPS=4 S:(SBP>69)&(SBP<90) SBPS=3 S:(SBP>49)&(SBP<70) SBPS=2 S:
SBP<50 SBPS=1
CR      R !!,"CAPILLARY REFILL 'N(ORMAL), D(ELAYED), A(BSENT)' > ",CR
        W:CR'?1"N"&(CR'?1"D")&(CR'?1"A") !,"INVALID RESPONSE (TYPE 'N','D', OR
N')"
        G:CR'?1"N"&(CR'?1"D")&(CR'?1"A") CR
        S:CR="N" CRS=2 S:CR="D" CRS=1 S:CR="A" CRS=0
GCS     R !!,"EYE OPENING",!,?5,"1. NONE",!,?5,"2. TO PAIN",!,?5,"3. TO VOICE",!
,?5,"4. SPONTANEOUS",!!,"NUMBER? > ",EOS
        W:EOS'?1N !,"INVALID RESPONSE"
        G:EOS'?1N GCS
        G:EOS>4 GCS
VERBR   R !!,"VERBAL RESPONSE",!,?5,"1. NONE",!,?5,"2. INCOMPREHENSIBLE SOUNDS",
!,?5,"3. INAPPROPRIATE WORDS",!,?5,"4. CONFUSED",!,?5,"5. ORIENTED",!!,"NUMBER?
> ",VRS
        W:VRS'?1N !,"INVALID RESPONSE"
        G:VRS'?1N VERBR
        G:VRS>5 VERBR
MTRR    R !!,"MOTOR RESPONSE",!,?5,"1. NONE",!,?5,"2. EXTENSION (PAIN)",!,?5,"3.
 FLEXION (PAIN)",!,?5,"4. WITHDRAW (PAIN)",!,?5,"5. PURPOSEFUL MOVEMENTS (PAIN)"
,!,?5,"6. OBEYS COMMANDS",!,"NUMBER? > ",MRS
        W:MRS'?1N !,"INVALID RESPONSE"
        G:MRS'?1N MTRR
        G:MRS>6 MTRR
        S GCA=MRS+VRS+EOS
        S:(GCA=14)!(GCA=15) GCS=5 S:(GCA=11)!(GCA=12)!(GCA=13) GCS=4 S:(GCA=8)!(
GCA=9)!(GCA=10) GCS=3 S:(GCA=5)!(GCA=6)!(GCA=7) GCS=2 S:(GCA=3)!(GCA=4) GCS=1
CMPT    S ANS="0;0;1;2;4;8;15;26;42;60;76;87;93;96;98;99"
        S TS=GCS+CRS+SBPS+RES+RRS
OPT     W !!!,"NAME:  ",NAM,!!,?5,"TRAUMA SCORE:  ",TS,!,?5,"PERCENTAGE SURVIVAL
:  ",$P(ANS,";",TS)


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*** OPERATIONAL DEFINITIONS OF TRAUMA SCORE ***

THE TRAUMA SCORE IS A NUMERICAL GRADING SYSTEM FOR ESTIMATING THE SEVERITY OF A BLUNT OR PENETRATING INJURY. THE SCORE IS COMPOSED OF THE GLASGOW COMA SCALE AND MEASUREMENTS OF CARDIOPULMONARY FUNCTION.

EACH PARAMETER IS GIVEN A NUMBER (HIGH FOR NORMAL AND LOW FOR IMPAIRED FUNCTION). SEVERITY OF INJURY IS ESTIMATED BY SUMMING THE NUMBERS. THE LOWEST SCORE IS '1', AND THE HIGHEST SCORE IS '16'.

RESPIRATORY RATE (NUMBER OF RESPIRATIONS IN 15 SECONDS MULTIPLIED BY FOUR)

RATE	SCORE (TRAUMA)
10-24/MIN	4
24-35/MIN	3
36/MIN OR GREATER	2
1-9/MIN	1
NONE	0

RESPIRATORY EXPANSION

NORMAL (NORMAL RESPIRATORY EXPANSION)

REFRACTIVE (USE OF ACCESSORY MUSCLES OR INTERCOSTAL MUSCLE RETRACTION)

EXPANSION	SCORE (TRAUMA)
NORMAL	1
REFRACTIVE	0

SYSTOLIC BLOOD PRESSURE (CUFF PRESSURE)

BLOOD PRESSURE IS TAKEN IN EITHER ARM (AUSCULTATION OR PALPATION TECHNIQUE)

PRESSURE	SCORE (TRAUMA)
90MM HG OR HIGHER	4
70-89MM HG	3
50-69MM HG	2
0-49MM HG	1
NO PULSE	0

CAPILLARY REFILL

NORMAL (NAIL BED, FOREHEAD, OR LIP MUCOSA COLOR REFILL IN 2 SECONDS)

DELAYED (MORE THAN 2 SECONDS CAPILLARY REFILL)

ABSENT (NO CAPILLARY REFILL)

REFILL	SCORE (TRAUMA)
NORMAL	2
DELAYED	1
ABSENT	0

EYE OPENING (SPONTANEOUS,TO VOICE, TO PAIN, NONE)

CONDITION	SCORE (GLASGOW COMA SCALE)
SPONTANEOUS	4
TO VOICE	3
TO PAIN	2
NONE	1

VERBAL RESPONSE (AROUSES WITH VOICE OR PAINFUL STIMULUS)

RESPONSE	SCORE (GLASGOW COMA SCALE)
ORIENTED	5
CONFUSED	4
INAPPROPRIATE WORDS	3
INCOMPREHENSIBLE WORDS	2
NONE	1

MOTOR RESPONSE (RESPONDS TO COMMAND OR PAINFUL STIMULUS)

RESPONSE	SCORE (GLASGOW COMA SCALE)
OBEYS COMMAND	6
LOCALIZES PAIN	5
WITHDRAWS TO PAIN	4
FLEXION TO PAIN	3
EXTENSION TO PAIN	2
NONE	1

CONVERT GLASGOW SCORE TO TRAUMA SCORE:

GLASGOW SCORE	TRAUMA SCORE
14-15	5
11-13	4
8-10	3
5- 7	2
3- 4	1

PROJECTED ESTIMATE OF SURVIVAL FOR EACH VALUE OF THE TRAUMA SCORE BASED ON RESULTS FROM 1,509 PATIENTS WITH BLUNT OR PENETRATING INJURY.

TRAUMA SCORE	PERCENTAGE SURVIVAL
16	99
15	98
14	96
13	93
12	87
11	76
10	60
9	42
8	26
7	15
6	8
5	4
4	2
3	1
2	0
1	0

RETURN TO MAIN MENU? (Y OR N) >

```
     THIS PROGRAM CALCULATES THE PROJECTED ESTIMATE OF SURVIVAL FOR
INDIVIDUALS SUFFERING FROM BLUNT OR PENETRATING INJURIES BASED ON THE GLASGOW
COMA SCALE.

NAME (LAST,FIRST MI)? > DOE,JOHN Q

RESPIRATORY RATE (NUMBER OF RESPIRATIONS IN 15 SECS)? > 4

RESPIRATORY EFFORT 'N(ORMAL) OR R(EFRACTIVE)' > N

SYSTOLIC BLOOD PRESSURE (EITHER ARM, AUSCULTATE OR PALPATE) > 120

CAPILLARY REFILL 'N(ORMAL), D(ELAYED), A(BSENT)' > N

EYE OPENING
     1. NONE
     2. TO PAIN
     3. TO VOICE
     4. SPONTANEOUS

NUMBER? > 4

VERBAL RESPONSE
     1. NONE
     2. INCOMPREHENSIBLE SOUNDS
     3. INAPPROPRIATE WORDS
     4. CONFUSED
     5. ORIENTED

NUMBER? > 5

MOTOR RESPONSE
     1. NONE
     2. EXTENSION (PAIN)
     3. FLEXION (PAIN)
     4. WITHDRAW (PAIN)
     5. PURPOSEFUL MOVEMENTS (PAIN)
     6. OBEYS COMMANDS
NUMBER? > 6

NAME:  DOE,JOHN Q

     TRAUMA SCORE:  16
     PERCENTAGE SURVIVAL:  99
>
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     THIS PROGRAM CALCULATES THE PROJECTED ESTIMATE OF SURVIVAL FOR
INDIVIDUALS SUFFERING FROM BLUNT OR PENETRATING INJURIES BASED ON THE GLASGOW
COMA SCALE.

NAME (LAST,FIRST MI)? > SMITH,JOHN

RESPIRATORY RATE (NUMBER OF RESPIRATIONS IN 15 SECS)? > 2

RESPIRATORY EFFORT 'N(ORMAL) OR R(EFRACTIVE)' > R

SYSTOLIC BLOOD PRESSURE (EITHER ARM, AUSCULTATE OR PALPATE) > 95

CAPILLARY REFILL 'N(ORMAL), D(ELAYED), A(BSENT)' > D

EYE OPENING
     1. NONE
     2. TO PAIN
     3. TO VOICE
     4. SPONTANEOUS

NUMBER? > 2

VERBAL RESPONSE
     1. NONE
     2. INCOMPREHENSIBLE SOUNDS
     3. INAPPROPRIATE WORDS
     4. CONFUSED
     5. ORIENTED

NUMBER? > 3

MOTOR RESPONSE
     1. NONE
     2. EXTENSION (PAIN)
     3. FLEXION (PAIN)
     4. WITHDRAW (PAIN)
     5. PURPOSEFUL MOVEMENTS (PAIN)
     6. OBEYS COMMANDS
NUMBER? > 3


NAME:  SMITH,JOHN

     TRAUMA SCORE:  9
     PERCENTAGE SURVIVAL:  42
>
```

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READ INSTRUCTIONS BEFORE COMPLETING FORM

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Data Entry
Field Medical Card
Electronic Data Tag

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

Communication of medical information is critical in a combat environment where the casualty is treated at several different echelons of the evacuation chain. A system designed to provide this communication would include a microprocessor at the third echelon of care. Data would be entered into the microprocessor via a revised medical card with machine readable information, an electronically encoded data tag, and portable terminals. These data then would be used to create data sheets for the permanent inpatient record, and reports could be

generated for medical regulation, supply, and personnel accounting. Also, analyses could be performed for epidemiology and medical intelligence.

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